Careers in Engineering

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Career Day at Lutheran West

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What is Engineering?

- The branch of science and technology concerned with the design, building, and use of engines, machines, and structures [Wikipedia]
- Many fields of engineering
  - Civil, Electrical, Mechanical, Chemical
  - Aerospace, Automotive, Computer, Materials
  - Systems, Biomedical, Environmental, Robotics
  - And many more

What Does an Engineer Do?

- Identifies a need
  - new or improved product, technology gap, etc
- Advocates/supports project planning
  - Part of a team with management, technical staff
- Develops test plans
- Acquire data by experiment or simulation
- Write technical reports
- Present results to peers and industry
- Stays informed. Look, listen and read about what others are doing - Always learning

Working Conditions

- Mostly within an office – desk, computer, phone are most used tools
- Laboratory or test area
  - Wind tunnel, test chamber, airplane, car, greenhouse, wind farm, etc
  - Special equipment might be needed for work in these environments

Wages & Employment Outlook

- Good source for this info is the Ohio Career Information System https://ocis.org
- Range $37K to $107K for BS degree in Ohio median wages depending on the field
  - Geographic information Systems Specialist
  - Petroleum Engineer
- Job opportunities in engineering are expected to increase slowly in the near future [OCIS].

Who Becomes an Engineer/What Skills Are Needed?

- People that like to understand how things work and make them better
- Skills Needed:
  – Good at math & science, computer savy
  – problem-solvers
  – detail-oriented
  – Team players
  – Good communicator (written and verbal)

Preparation/Training for Engineering

- Bachelor of Science (4+ year) required
- Master of Science and Doctorate are also available and seen in certain work areas
- Professional Engineering (PE) certification valuable in certain work areas

Helpful high school/college courses:

- Calculus, geometry, trigonometry, physics, chemistry, biology, computer programming, economics, English
- Shadow programs, summer internships, co-op

Aircraft Icing Research

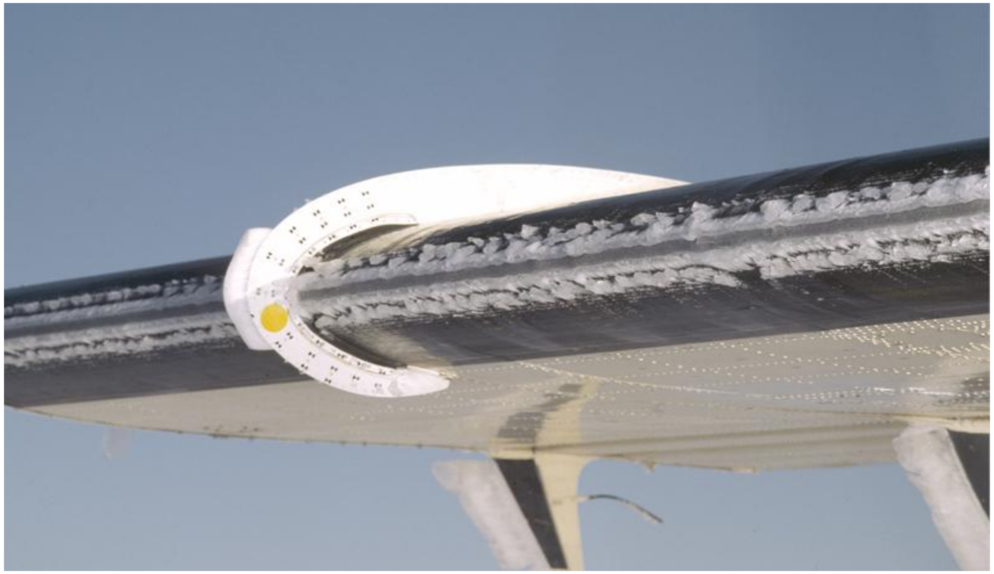
- What is aircraft icing?
- How does it affect flight?
- What is being done to remedy these effects?

What Is Aircraft Icing?

- Ground Icing
- In-Flight Icing

How Does Aircraft Icing Affect Flight?

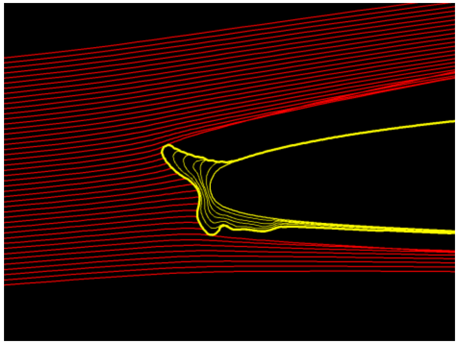
- Increases Drag
  - Decrease airspeed
  - Need more thrust
- Decreases Lift
  - Early stall
- Decreases Stability and Control
- Increases Weight
  - Typically a minor effect

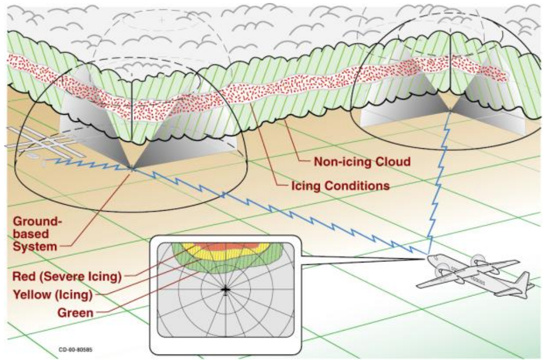


What is Being Done About It?

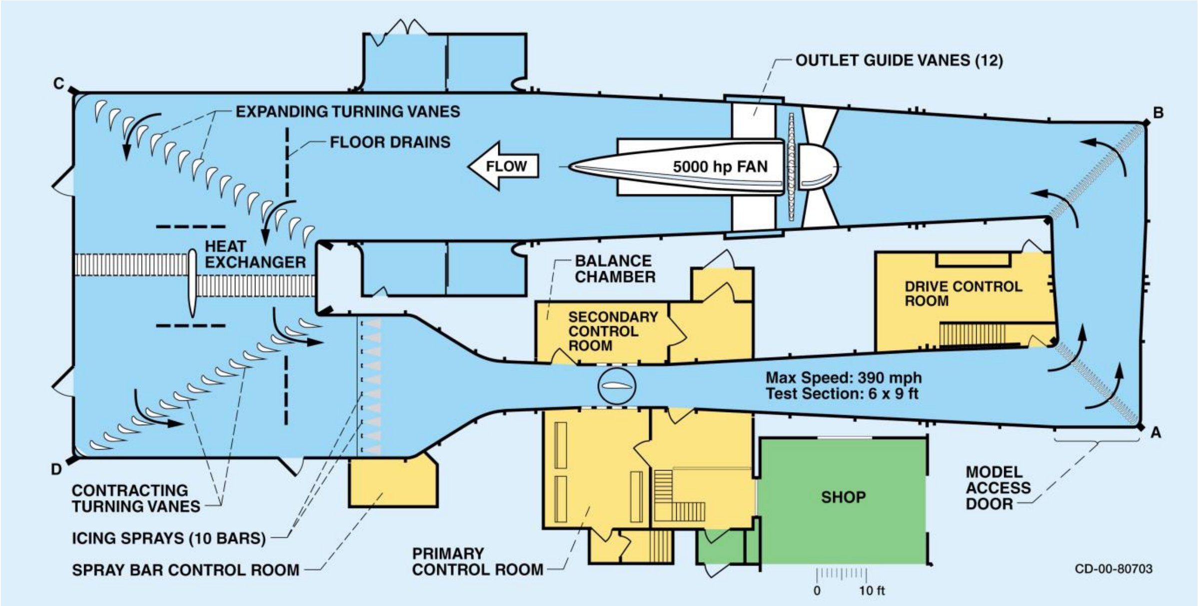
NASA is making flight in icing conditions safer through research, education and partnering with other government agencies, industry and academia.

- Developing methods for simulating the ice growth on aircraft surfaces
- Measuring the effects that ice has on the behavior of aircraft in flight
- Developing ice protection & detection systems
- Providing pilot education and training tools





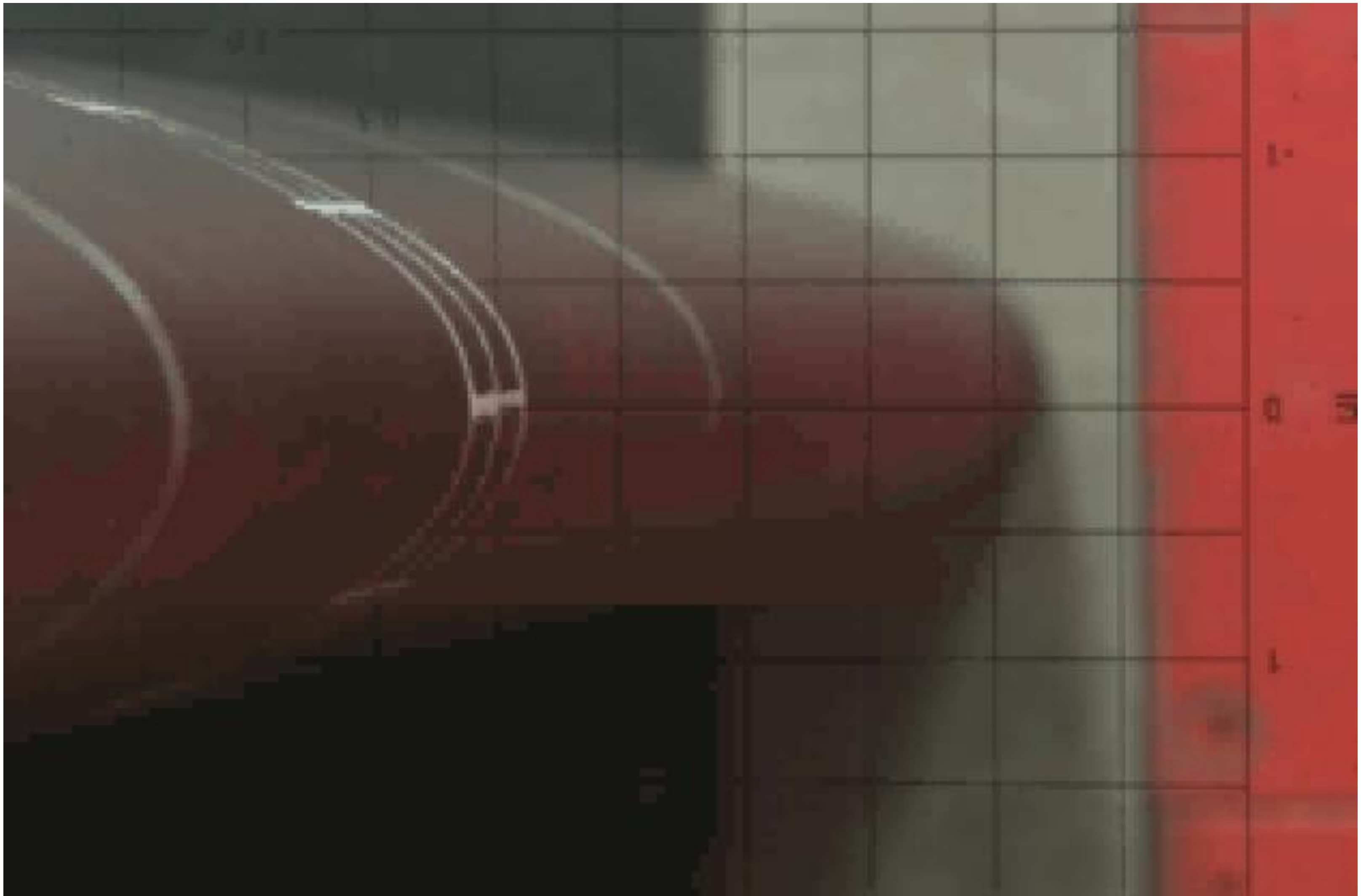
Facilities - Icing Research Tunnel



- Simulated Icing - controlled and repeatable artificial conditions that represent steady state atmospheric icing conditions
  - Research tests are done by NASA to understand icing phenomena, explore and develop physical models, new test methods, and validation databases
  - External tests are done by industry for IPS development and certification

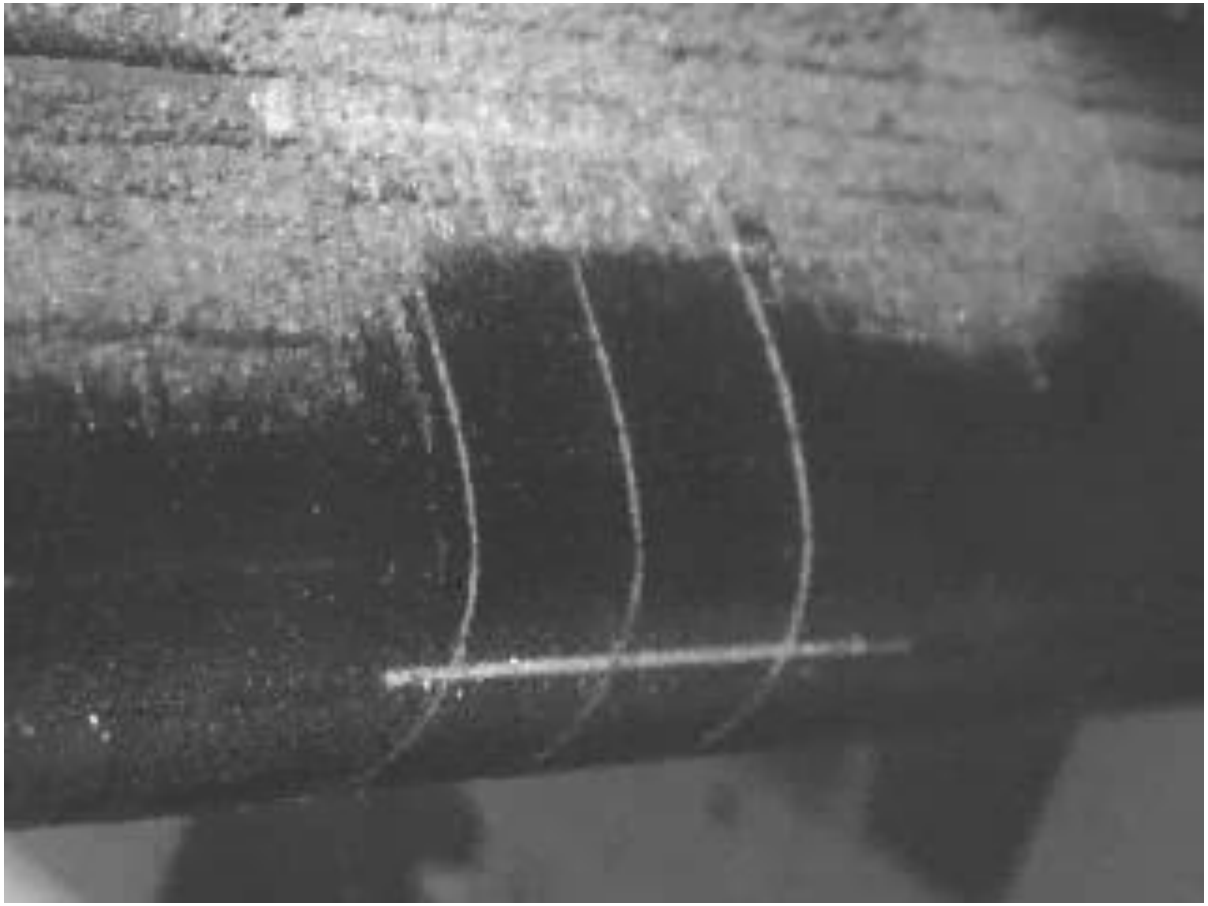
NASA Icing Research Tunnel

Visualization Tools: Time-Laps Video



NASA Icing Research Tunnel

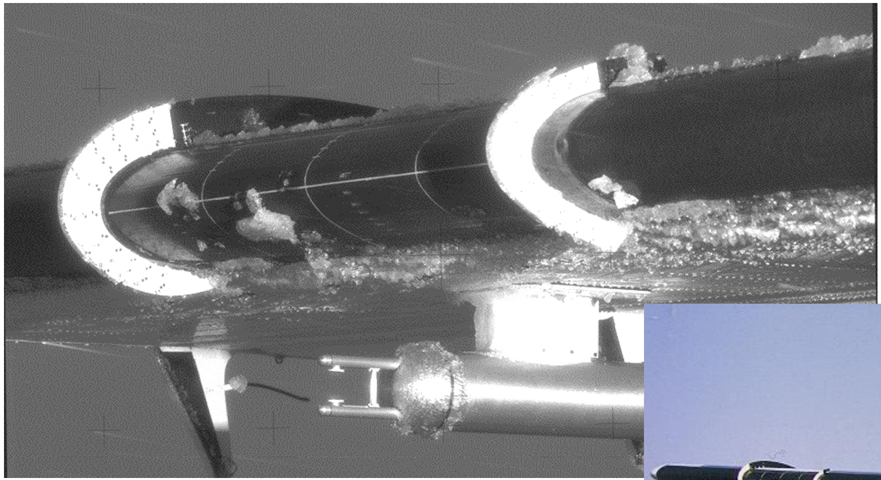
Visualization Tools: High Speed Video



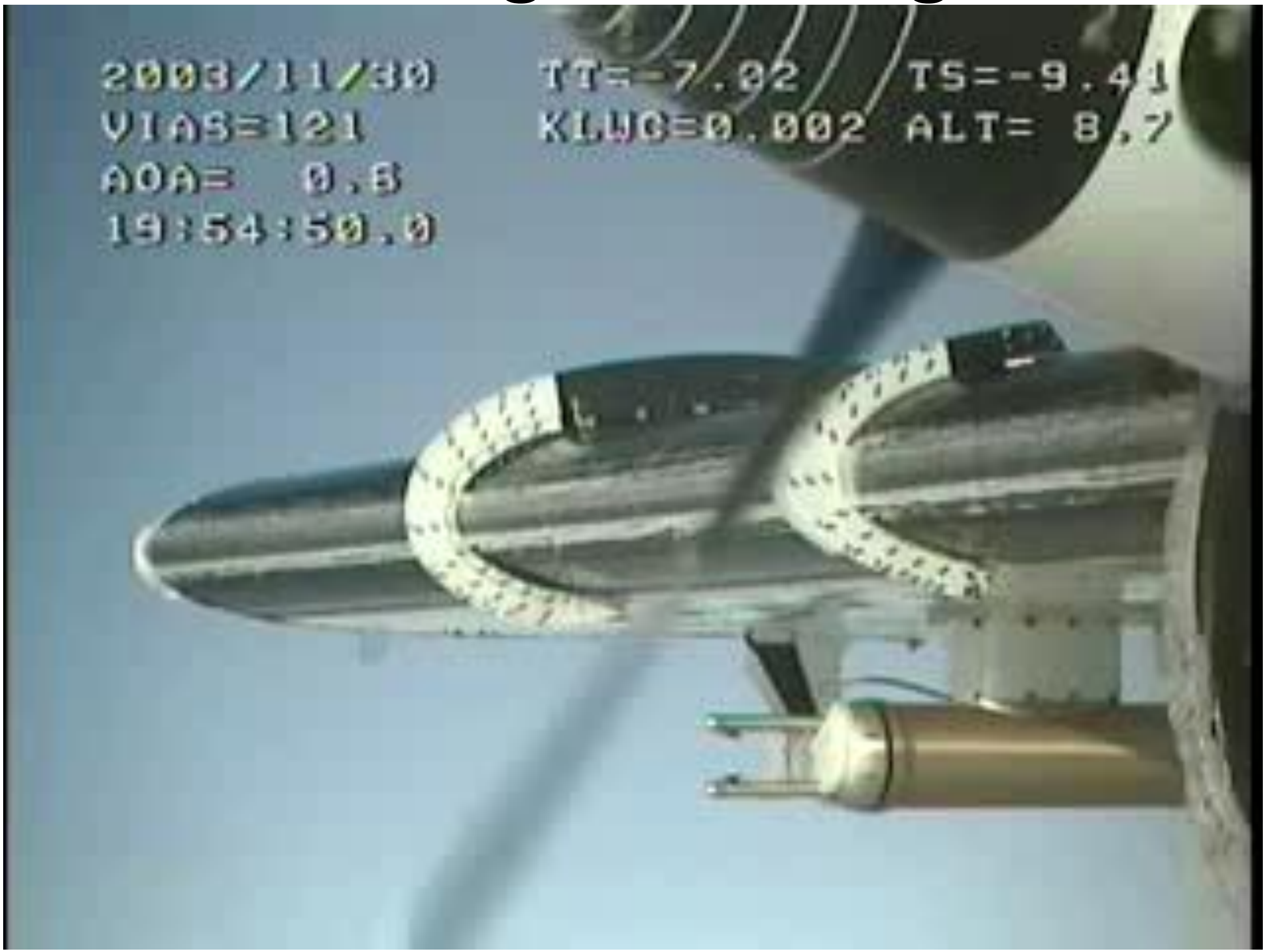
Facilities - Icing Research Aircraft

DH6-Twin Otter

- Natural Icing - characterize the icing atmospheric environment, examine the effects of icing phenomena in natural conditions, and explore iced flight dynamics



In-Flight De-Icing



Ice Contaminated Tailplane Stall

Icing Effects Flight Simulator

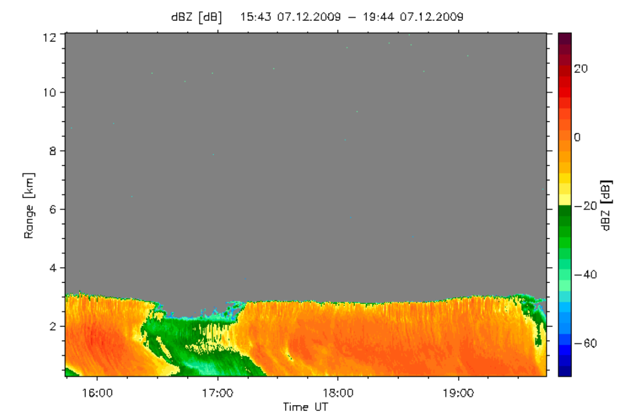
NASA
C-2004-1216

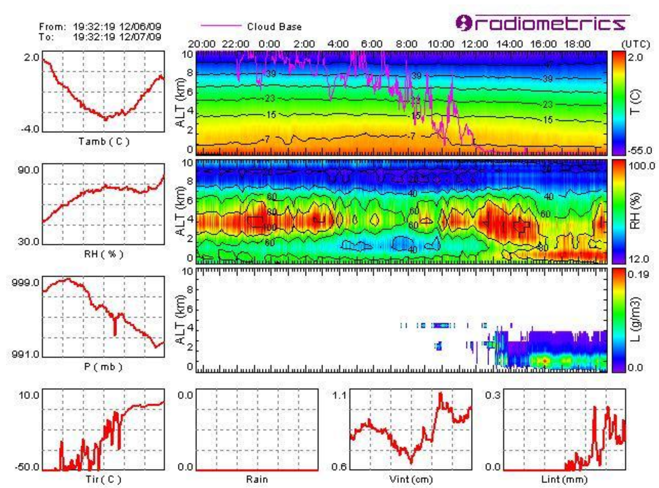
National Aeronautics and Space Administration
John H. Glenn Research Center at Lewis Field

Icing Effects Flight Simulator

Vertical pointing Icing R-S

- NASA Icing Remote Sensing System (NIRSS) Technologies
  - Radar
    - Provides cloud boundaries
  - Multi-frequency Microwave Radiometer
    - Provides Temperature Profile
    - Provides Integrated Water Content
  - Ceilometer
    - Refines cloud base boundary



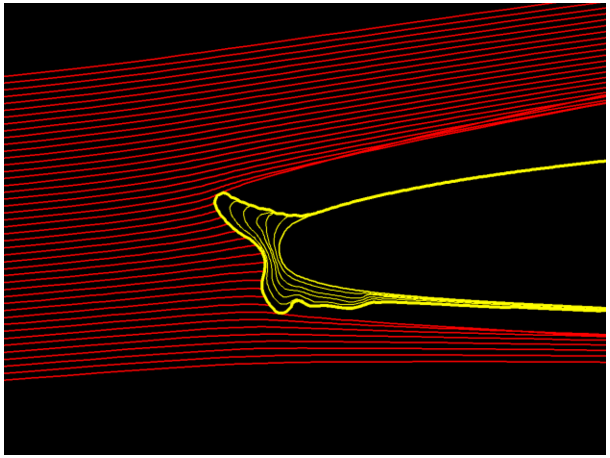


LEWICE 3.2.2
Ice Accretion Prediction

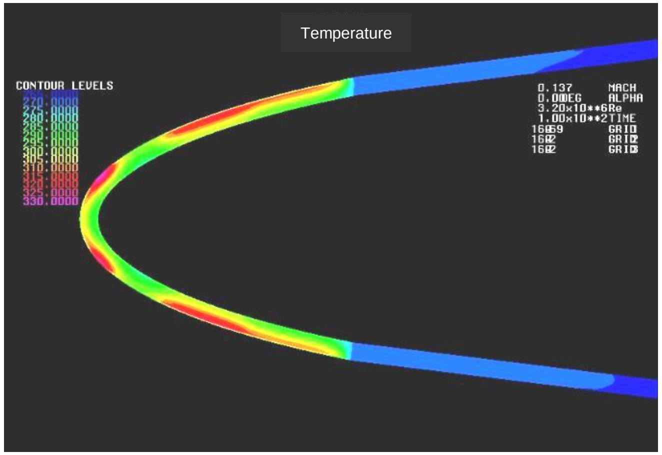
LEWICE is the flagship code for 2D ice accretion prediction

Features:

1) Flow solution using potential flow or structured viscous solver
2) Particle trajectory calculation, including impingement limit search for collection efficiency and multiple drop size distributions
3) Heat Transfer: Integral boundary layer routine calculates heat transfer coefficient
4) Quasi-steady analysis of control volume mass and energy balance in time stepping routine
5) Geometry modification using density correlations to convert ice growth mass into volume allows multiple time-step solutions
6) All physical effects modeled, including turbulence, buoyancy, droplet deformation, breakup and splashing
7) Extensive validation against experimental data



Droplet Trajectory and Ice Shape Prediction



Electro-Thermal System Performance


Questions?